

IEEE Standard Definitions for Power Switchgear

Sponsor
**Switchgear Committee
of the
IEEE Power Engineering Society**

Approved March 19, 1992
IEEE Standards Board

Reaffirmed 14 June 2001
IEEE SA-Standards Board

Approved 25 October 2001
American National Standards Institute

Abstract: Terms that encompass the products with the scope of the C37 project are defined. These include power switchgear for switching, interrupting, metering, protection, and regulating purposes as used primarily in connection with generation, transmission, distribution, and conversion of electric power. The definitions do not purport to embrace other meanings that the terms may properly have when used in connection with other subjects.

Keywords: power switchgear, definitions; power switchgear, terminology

The Institute of Electrical and Electronics Engineers, Inc. 345
East 47th Street, New York, NY 10017-2394, USA
Copyright © 1992 by the Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 1992. Printed in the United States of America
ISBN 1-55937-250-8

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the

IEEE Standards documents are developed within the Technical Committees of the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Board. Members of the committees serve voluntarily and without compensation. They are not necessarily members of the Institute. The standards developed within IEEE represent a consensus of the broad expertise on the subject within the Institute as well as those activities outside of IEEE which have expressed an interest in participating in the development of the standard.

Use of an IEEE Standard is wholly voluntary. The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE Standard is subjected to review at least every five years for revision or reaffirmation. When a document is more than five years old, and has not been reaffirmed, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE Standard.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments.

Interpretations: Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of all concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason IEEE and the members of its technical committees are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration.

Comments on standards and requests for interpretations should be addressed to:

Secretary, IEEE Standards Board
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
USA

IEEE Standards documents are adopted by the Institute of Electrical and Electronics Engineers without regard to whether their adoption may involve patents on articles, materials, or processes. Such adoption does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the standards documents.

Foreword

(This foreword is not a part of IEEE Std C37.100-1992, IEEE Standard Definitions for Power Switchgear.)

This standard continues the compilation of terms and definitions relating to power switchgear and should be considered to reflect common and current usage of that industry. It is an update of the 1981 revision with additions and changes.

The 1981 revision of this standard incorporated the definitions formerly contained in IEEE C37.90-1978, IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus (ANSI). The agreement to move these definitions from IEEE C37.90-1978 to IEEE C37.100-1981 was based on identifying the definitions for prime responsibility. Accordingly, the code shown was adopted and is used in the current edition as well. Each of the eight participating entities of the Power System Relaying, Substations, and Switchgear Committees of the Technical Operations Department of the IEEE Power Engineering Society identified definitions in which they had basic responsibility. This is shown immediately following the definition. The code indicates interest and consent required for any changes.

The size of this standard has been kept to a minimum by omitting all terms satisfactorily covered in readily available dictionaries. In many instances, terms and definitions of related products exhibiting minor variations have been combined for greater clarity.

International Electrotechnical Commission (IEC) definitions have been adopted wherever possible, without change, or with minor modifications.

Specifications and ratings have been excluded from definitions where possible. This information is included in standards covering the specific products.

The C37 Subcommittee on Definitions and Terms that prepared this revision of the standard was as follows:

H. W. Mikulecky, *Chair*

L. V. Chabala

G. W. Dolloff
K. J. Khunkhun

D. L. Swindler

The Subcommittee acknowledges the considerable effort and input provided by Ward Laubach.

The following persons were on the balloting committee that approved this standard for submission to the IEEE Standards Board:

C. S. Alexander	N. V. Holingren	A. F. Parks
R. J. Alton	P. L. Kolarik	D. F. Peelo
J. G. Angelis	D. G. Kumbera	G. O. Perkins
R. H. Arndt	S. R. Lambert	R. Ranjan
L. R. Beard	D. M. Larson	J. C. W. Ransom
H. L. Bowles	W. E. Laubach	J. E. Reed
M. T. Brown	J. G. Leach	A. B. Rishworth
J. H. Brunke	G. N. Lester	H. C. Ross
C. G. Burland	D. Lott	L. R. Saavedra
R. L. Capra	E. L. Luehring	L. H. Schmidt
L. V. Chabala	J. A. Maneatis	E. W. Schmunk
A. Dixon	R. L. Mattingly	C. A. Schwalbe
J. J. Dravis	R. Matulic	J. H. Simpson
C. J. Dvorak	P. C. Mayo	G. St. Jean
P. W. Dwyer	A. K. McCabe	D. L. Swindler
R. D. Garzon	L. V. McCall	S. H. Telander
L. W. Gaussa, Sr.	R. A. McMaster	F. C. Teufel
K. I. Gray	H. W. Mikulecky	E. F. Veverka
K. Hendrix	D. C. Mills	C. L. Wagner
H. L. Hess	G. F. Montillet	W. R. Wilson
W. F. Hoenigmann	F. J. Muench	B. F. Wirtz

When the IEEE Standards Board approved this standard on March 19, 1992, it had the following membership:

Marco W. Migliaro, *Chair*
Donald C. Loughry, *Vice Chair*
Andrew G. Salem, *Secretary*

Dennis Bodson	Donald N. Heirman	T. Don Michael*
Paul L. Borrill	Ben C. Johnson	John L. Rankine
Clyde Camp	Walter J. Karplus	Wallace S. Read
Donald C. Fleckenstein	Ivor N. Knight	Ronald H. Reimer
Jay Forster*	Joseph Koepfinger*	Gary S. Robinson
David F. Franklin	Irving Kolodny	Martin V. Schneider
Ramiro Garcia	D. N. "Jim" Logothetis	Terrance R. Whittemore
Thomas L. Hannan	Lawrence V. McCall	Donald W. Zipse

*Member Emeritus

Also included are the following nonvoting IEEE Standards Board liaisons:

Satish K. Aggarwal	Richard B. Engelman
James Beall	Stanley Warshaw

Kristin M. Dittmann, *IEEE Standards Project Editor*

Listed below are the codes for the committees responsible for each of the definitions in this standard. The first designation after a definition indicates the prime responsibility; subsequent designation(s) indicate interest and consent required for changes:

PSRC	Power System Relaying Committee, Relay Standards Subcommittee
SUB	Substation Committee
HVF, Swg	Switchgear Committee, High-Voltage Fuses Subcommittee
HVS, Swg	Switchgear Committee, High-Voltage Switches Subcommittee
LVSwgD	Switchgear Committee, Low-Voltage Switchgear Devices Subcommittee
HVCB,Swg	Switchgear Committee, High-Voltage Circuit Breaker Subcommittee
R and S, Swg	Switchgear Committee, Reclosers and Sectionalizers Subcommittee
SwgA	Switchgear Committee, Switchgear Assemblies Subcommittee

CLAUSE	PAGE
1 Scope	1
2 General	1
3 References	1
4 Definitions.....	7

IEEE Standard Definitions for Power Switchgear

1. Scope

The terms and definitions in the standard are intended to encompass the products within the scope of the C37 project that include power switchgear for switching, interrupting, metering, protection, and regulating purposes as used primarily in connection with generation, transmission, distribution, and conversion of electric power.

The definitions of terms and explanatory notes relating thereto contained in this standard are not intended to embrace all possible meanings of the terms. They are intended for the sole purpose of establishing only those meanings of terms used in switchgear standards. They do not purport to embrace other meanings that the terms may properly have when used in connection with other subjects.

In some instances, terms and definitions that are not identical to those in this standard have been developed by other branches of industry. Where this situation exists, the definitions in this standard shall be used for power switchgear within the C37 product scope.

2. General

In this standard, preferred terms are in some instances followed by less favored or alternate terms in parentheses. Also, since the terms are arranged alphabetically, application phrases have been parenthetically appended to many terms.

For definitions of terms of related component parts, accessories, etc., not covered in this standard, reference should be made to standards covering those products; for example, IEEE C57.13-1978, and IEEE Std 21-1976.

3. References

When the standards referred to in this standard are superseded by an approved revision, the latest revision shall be used.

[1] ANSI C84.1-1989, American National Standard for Electric Power Systems and Equipment—Voltage Ratings (60 Hz).¹

¹ ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

[2] ANSI S1.13-1971 (Reaff 1986), American National Standard Methods for the Measurement of Sound Pressure Levels.

[3] ASTM D 2472-92, Specification for Sulfur Hexafluoride.²

[4] IEEE C37.09-1979 (Reaff 1988), IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis (ANSI).³

4 Definitions

a auxiliary switch: *See:* **auxiliary switch** and **a contact (front contact)**.

LVSwgD; HVCB, Swg

a contact (front contact): A contact that is open when the main device is in the standard reference position and that is closed when the device is in the opposite position.

LVSwgD; PSRC; HVCB, Swg

NOTES:

1 — *a* contact has general application. However, this meaning for front contact is restricted to relay parlance.

2 — For indication of the specific point of travel at which the contact changes position, an additional letter or percentage figure may be added to *a*.

3 — See standard reference position.

aa auxiliary switch: *See:* **auxiliary switch** and **aa contact**.

LVSwgD; HVCB, Swg

aa contact: A contact that is open when the operating mechanism of the main device is in the standard reference position and that is closed when the operating mechanism is in the opposite position.

LVSwgD; HVCB, Swg

NOTE — *See:* **standard reference position (of a contact)**

accelerating relay: A programming relay whose function is to control the acceleration of rotating electrical equipment.

PSRC

acceptance tests: *See:* **conformance tests**

NOTE — American National Standards should use the term *conformance test*, as directed by the Standards Council of ANSI, rather than the term *acceptance test*. Use of the term *conformance test* avoids the implication of contractual relations between buyer and seller.

accessories: Devices that perform a secondary or minor duty as an adjunct or refinement to the primary or major duty of a unit of equipment.

HVS, Swg; LVSwgD

acting stress (working stress): The maximum applied or expected stress in a material during operation of the apparatus of which it is a part and including the stresses caused by gas pressure, wind, ice, or seismic loading.

SUB

active power relay: A power relay that responds to active power.

PSRC

NOTE — *See:* **power relay** and **reactive power relay**

² ASTM publications are available from the Customer Service Department, American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103, USA.

³ IEEE publications are available from the Institute of Electrical and Electronics Engineers, Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA.

actual transient recovery voltage (TRV): That which actually occurs across the terminals of a pole of a switching device following current interruption.

HVCB, Swg

NOTE — The actual TRV may differ from the inherent TRV due to the modifying effects of device impedance and arc-circuit interaction.

actuating current (of an automatic line sectionalizer): The rms current that actuates a counting operating or an automatic operation.

R and S, Swg

aging: The effects of operational, environmental, and system conditions on equipment during a period of time up to, but not including, design basis events, or the process of simulating these effects.

PSRC

air-blast circuit breaker: See NOTE (2) under **circuit breaker**.

air circuit breaker: See NOTE (2) under **circuit breaker**.

air switch: A switching device designed to close and open one or more electric circuits by means of guided separable contacts that separate in air.

HVS, Swg

alarm condition: A predefined change in the condition of equipment or the failure of equipment to respond correctly. Indication may be audible, visual, or both.

SUB

alarm (signal) relay: A monitoring relay whose function is to operate an audible or visual signal to announce the occurrence of an operation or a condition needing personnel attention, and which is usually provided with a signaling cancellation device.

PSRC

alarm switch (of a switching device): An auxiliary switch that actuates a signaling device upon the automatic opening of the switching device with which it is associated.

LVS_{wgD}

alternating-current component (of a total current): See: **symmetrical component (ac component) (of a total current)**

ambient air temperature: The temperature of the surrounding air that comes in contact with equipment.

SwgA

NOTE — Ambient air temperature, as applied to enclosed switchgear assemblies, is the average temperature of the surrounding air that comes in contact with the enclosure.

ambient temperature: The temperature of the surrounding medium that comes in contact with the device or equipment.

LVS_{wgD}; HVE, Swg; HVS, Swg

amplitude factor (of transient recovery voltage): The ratio of the highest peak of the transient recovery voltage to the peak value of the normal-frequency recovery voltage.

HVCB, Swg

NOTE — In tests made under one condition to simulate duty under another, as in single-phase tests made to simulate duty on three-phase ungrounded faults, the amplitude factor is expressed in terms of the duty being simulated.

analog device: A device that operates with variables represented by continuously measured quantities such as voltages, resistances, rotations, and pressures.

SUB

analog quantity: A continuous variable that is typically digitized and represented as a scalar value.

SUB

analog telemetering: Telemetering in which some characteristic of the transmitter signal is proportional to the quantity being measured.

SUB

analog-to-digital (a/d) conversion: Production of a digital output corresponding to the value of an analog input quantity.

SUB

analog-to-digital converter (digitizer): A device or a group of devices that converts an analog quantity or analog position input signal into some type of numerical output signal or code. The input signal is either the measurand or a signal derived from it.

SUB

anode circuit breaker: A low-voltage power circuit breaker (1) that is designed for connection in an anode of a mercury-arc power rectifier unit, (2) that trips automatically only on reverse current and starts reduction of a current in a specified time when the arc-back occurs at the end of the forward current conduction, and (3) that substantially interrupts the arc-back current within one cycle of the fundamental frequency after the beginning of the arc-back.

LVSwgD

NOTE — The specified time in present practice is 0.008 s or less (at an ac frequency of 60 Hz).

antipump (pump-free) device: A device that prevents reclosing after an opening operation as long as the device initiating closing is maintained in the position for closing.

HVCB, Swg; LVSwgD

anti-single-phase tripping device: A device that operates to open all phases of a circuit by means of a polyphase switching device, in response to the interruption of the current in one phase.

LVSwgD

NOTES:

1 — This device prevents single phasing of connected equipment resulting from the interruption of any one phase of the circuit.

2 — This device may sense operation of a specific single-phase interrupting device or may sense loss of single-phase potential.

applied-fault protection: A protective method in which, as a result of relay action, a fault is intentionally applied at one point in an electrical system in order to cause fuse blowing or further relay action at another point in the system.

PSRC

arc chute (of a switching device): A structure affording a confined space or passageway, usually lined with arc-resisting material, into or through which an arc is directed to extinction.

LVSwgD; HVCB, Swg

arc-extinguishing medium (fuse filler) (of a fuse): Material included in the fuse to facilitate current interruption.

HVF, Swg

arc reach: The distance from a point midway between the arc extremities to the most remote point of the arc at the time of its maximum length.

HVS, Swg

arc-shunting-resistor-current arcing time: The interval between the parting of the secondary arcing contacts and the extinction of the arc-shunting-resistor current.

HVCB, Swg

arcing contacts: The contacts of a switching device on which the arc is drawn after the main (and intermediate, where used) contacts have parted.

HVS, Swg; LVSwgD; HVCB, Swg

arcing horn: One of a pair of diverging electrodes on which an arc is extended to the point of extinction after the main contacts of the switching device have parted.

HVS, Swg

NOTE — Arcing horns are sometimes referred to as arcing runners.

arcing time (of a fuse): The time elapsing from the severance of the current-responsive element to the final interruption of the circuit.

HVF, Swg

arcing time (of a mechanical switching device): The interval of time between the instant of the first initiation of the arc and the instant of final arc extinction in all poles.

LVSwgD; HVCB, Swg

NOTE — For switching devices that embody switching resistors, a distinction should be made between the arcing time up to the instant of the extinction of the main arc, and the arcing time up to the instant of the breaking of the resistance current.

armature (of a relay): The moving element of an electromechanical relay that contributes to the designed response of the relay and that usually has associated with it a part of the relay contact assembly.

PSRC

articulated unit substation: A unit substation in which the incoming, transforming, and outgoing sections are manufactured as one or more subassemblies intended for connection in the field.

SwgA

assembly(GIS): Gas-insulated substation fully erected.

SUB

asymmetrical current: See: **total (asymmetrical) current**

attachments: Accessories to be attached to switchgear apparatus, as distinguished from auxiliaries.

HVS, Swg; LVSwgD

automatic: Pertaining to a process or device that, under specified conditions, functions without intervention by a human operator.

SUB

automatic capacitor control equipment: A piece of equipment that provides automatic control for functions related to capacitors, such as their connection to and disconnection from a circuit in response to predetermined conditions such as voltage, load, or time.

SUB; R and S, Swg

automatic circuit recloser: A self-controlled device for automatically interrupting and reclosing an alternating-current circuit, with a predetermined sequence of opening and reclosing followed by resetting, hold-closed, or lock-out operation.

R and S, Swg

NOTE — When applicable, it includes an assembly of control elements required to detect overcurrents and control the recloser operation.

automatic control: An arrangement of electrical controls that provides for switching or otherwise controlling or both in an automatic sequence and under predetermined conditions the necessary devices comprising a piece of equipment. These devices thereupon maintain the required character of service and provide adequate protection against all unusual operating emergencies.

SUB

automatic control equipment: Equipment that provides automatic control for a specified type of power circuit or apparatus.

SUB

automatic line sectionalizer: A self-contained circuit-opening device that automatically opens the main electrical circuit through it after sensing and responding to a predetermined number of successive main current impulses equal to or greater than a predetermined magnitude. It opens while the main electrical circuit is de-energized. It may also have provision to be manually operated to interrupt loads.

R and S, Swg

NOTE — When applicable, it includes an assembly of control elements required to detect overcurrents and control the sectionalizer operation.

automatic load throw-over equipment (transfer or switchover): Equipment that automatically transfers a load to another source of power when the original source to which it has been connected fails, and that automatically restores the load to the original source under desired conditions.

SUB

NOTE — The restoration of the load to the preferred source from the emergency source upon reenergization of the preferred source after an outage may be of the continuous circuit restoration type or interrupted circuit restoration type.

- 1) **equipment of the nonpreferential type:** Equipment that automatically restores the load to the original source only when the other source, to which it has been connected, fails.
- 2) **fixed preferential type:** Equipment in which the original source always serves as the preferred source and the other source as the emergency source. The automatic transfer equipment will restore the load to the preferred source upon its reenergization.
- 3) **selective preferential type:** Equipment in which either source may serve as the preferred or the emergency source of pre-selection as desired, and that will restore the load to the preferred source upon its reenergization.
- 4) **semiautomatic load throw-over equipment:** Equipment that automatically transfers a load to another (emergency) source of power when the original (preferred) source to which it has been connected fails, but that requires manual restoration of the load to the original source.

automatic machine control equipment: Equipment that provides automatic control for functions related to rotating machines or power rectifiers.

SUB

automatic opening (tripping): The opening of a switching device under predetermined conditions without the intervention of an attendant.

LVS_{wgD}; HVCB, Swg; R and S, Swg

automatic operation (of a switching device): The ability to complete an assigned sequence of operations by automatic control without the assistance of an attendant.

R and S, Swg

automatic reclosing equipment: Automatic equipment that provides for reclosing a switching device as desired after it has opened automatically under abnormal conditions.

SUB; R and S, Swg

NOTE — Automatic reclosing equipment may be actuated by conditions sensed on either or both sides of the switching device as designed.

automatic station: A station (usually unattended) that under predetermined conditions goes into operation by an automatic sequence; that thereupon by automatic means maintains the required character of service within its capability; that goes out of operation by automatic sequence under other predetermined conditions; and includes protection against the usual operating emergencies.

SUB

NOTE — An automatic station may go in and out of operation in response to predetermined voltage, load, time, or other conditions, or in response to supervisory control or to a remote or local manually operated control device.

automatic transfer (or throw-over) equipment: Equipment that automatically transfers a load to another source of power when the original source to which it has been connected fails, and that will automatically retransfer the load to the original source under desired conditions.

SUB

NOTES:

- 1 — It may be of the nonpreferential, fixed-preferential, or selective-preferential type.
- 2 — Compare with transfer switch where transfer is accomplished without current interruption.

automatic transfer (or throw-over) equipment of the fixed-preferential type: Automatic transfer equipment in which the original source always serves as the preferred source and the other source as the emergency source. The automatic transfer equipment will retransfer the load to the preferred source upon its reenergization.

SUB

NOTE — The restoration of the load to the preferred source from the emergency source upon the reenergization of the preferred source after an outage may be of the continuous-circuit restoration type or the interrupted-circuit restoration type.

automatic transfer (or throw-over) equipment of the nonpreferential type: Automatic transfer equipment that automatically retransfers the load to the original source only when the other source, to which it has been connected, fails.

SUB

automatic transfer (or throw-over) equipment of the selective-preferential type: Automatic transfer equipment in which either source may serve as the preferred or the emergency source of preselection as desired, and which will retransfer the load to the preferred source upon its reenergization.

SUB

NOTE — The restoration of the load to the preferred source from the emergency source upon the reenergization of the preferred source after an outage may be of the continuous-circuit restoration type or the interrupted-circuit restoration type.

automatic transformer control equipment: Equipment that provides automatic control for functions relating to transformers, such as their connection, disconnection or regulation in response to predetermined conditions such as system load, voltage or phase angle.

SUB

automatic tripping: *See: automatic opening (tripping)*

automatically reset relay: *See: self-reset relay*

auxiliaries: Accessories to be used with switchgear apparatus but not attached to it, as distinguished from attachments.

HVS, Swg; LVSwgD; R and S, Swg

auxiliary circuit breaker: The circuit breaker used to disconnect the current circuit from direct connection with the test circuit breaker.

HVCB, Swg

auxiliary circuits: All control, indicating and measuring circuits.

SUB

auxiliary relay: A relay whose function is to assist another relay or control device in performing a general function by supplying supplementary actions.

PSRC; HVCB, Swg

NOTES:

- 1 — Some of the specific functions of an auxiliary relay are as follows:
 - a) Reinforcing contact current-carrying capacity of another relay or device.
 - b) Providing circuit seal-in functions.
 - c) Increasing available number of independent contacts.
 - d) Providing circuit-opening instead of circuit-closing contacts or vice-versa.
 - e) Providing time delay in the completion of a function.
 - f) Providing simple functions for interlocking or programming.
- 2 — The operating coil of the contacts of an auxiliary relay may be used in the control circuit of another relay or other control device. *Example:* An auxiliary relay may be applied to the auxiliary contact circuits of a circuit breaker in order to coordinate closing and tripping control sequences.
- 3 — A relay that is auxiliary in its functions even though it may derive its driving energy from the power system current or voltage is a form of auxiliary relay. *Example:* A timing relay operating from current or potential transformers.
- 4 — Relays that, by direct response to power system input quantities, assist other relays to respond to such quantities with greater discrimination are NOT auxiliary relays. *Example:* Fault detector relay.
- 5 — Relays that are limited in function by a control circuit, but are actuated primarily by system input quantities, are NOT auxiliary relays. *Example:* Torque-controlled relays.

auxiliary relay driver: A circuit that supplies an input to an auxiliary relay.

PSRC

auxiliary switch: A switch mechanically operated by the main device for signaling, interlocking, or other purposes.
LVS_{SwgD}; HV_{Swg}, Swg

NOTE — Auxiliary switch contacts are classed as follows: *a*, *b*, *aa*, *bb*, *LC*, etc., for the purpose of specifying definite contact positions with respect to the main device.

availability: The ratio of uptime and uptime plus downtime.
SUB

available (prospective) current (of a circuit with respect to a switching device situated therein): The current that would flow in that circuit if each pole of the switching device were to be replaced by a link of negligible impedance without any other change in the circuit or the supply.
LVS_{SwgD}

available (prospective) short-circuit current (at a given point in a circuit): The maximum current that the power system can deliver through a given circuit point to any negligible impedance short circuit applied at the given point, or at any other point that will cause the highest current to flow through the given point.
HVF, Swg; LVS_{SwgD}

NOTES:

- 1 — This value can be in terms of either symmetrical or asymmetrical; peak or rms current, as specified.
- 2 — In some resonant circuits the maximum available short-circuit current may occur when the short circuit is placed at some other point than the given one where the available current is measured.

available (prospective) short-circuit test current (at the point of test): The maximum short-circuit current for any given setting of a test circuit that the test power source can deliver at the point of test, with the test circuit short-circuited by a link of negligible impedance at the line terminals of the device to be tested.
HVF, Swg; LVS_{SwgD}

NOTE — This value can be in terms of either symmetrical or asymmetrical; peak or rms current, as specified.

average inside air temperature (of enclosed switchgear): The average temperature of the surrounding cooling air that comes in contact with the heated parts of the apparatus within the enclosure.
SwgA

***b* auxiliary switch:** See: auxiliary switch and *b*contact (back contact).

***b* contact (back contact):** A contact that is closed when the main device is in the standard reference position and that is open when the device is in the opposite position.
LVS_{SwgD}; PSRC; HV_{Swg}, Swg

NOTES:

- 1 — *b* contact has general application. However, this meaning for back contact is restricted to relay parlance.
- 2 — For indication of the specific point of travel at which the contact changes position, an additional letter or percentage figure may be added to *b*.

See: **standard reference position**

back-connected device: A device in which the current-carrying conductors are fastened to the studs in the rear of the mounting base.
HVF, Swg; HVS, Swg

backfeed: To energize a section of a power network that is supplied from a source other than its normal source.
PSRC

backup: Provision for an alternate means of operation if the primary system is not available.
SUB

backup current-limiting fuse: A fuse capable of interrupting all currents from the rated maximum interrupting current down to the rated minimum interrupting current.
HVF, Swg

backup, degraded: A backup capability that does not perform all the functions of the primary system.

SUB

backup protection (as applied to a relay system): A form of protection that operates independently of specified components in the primary protective system. It may duplicate the primary protection or may be intended to operate only if the primary protection fails or is temporarily out of service.

PSRC

balance beam (of a relay): A lever form of relay armature, one end of which is acted upon by one input and the other end restrained by a second input.

PSRC

balance relay: A relay that operates by comparing the magnitudes of two similar input quantities.

PSRC

NOTE — The balance may be effected by counteracting electromagnetic forces on a common armature, or by counter-acting magnetomotive forces in a common magnetic circuit, or by similar means, such as springs, levers, etc.

barrier: A partition for the insulation or isolation of electric circuits or electric arcs.

HVE, Swg; HVS, Swg; HVCB, Swg

base (high-voltage fuse): The supporting member to which the insulator unit or units are attached.

HVE, Swg

baseline data: Initial data needed to show acceptable functioning of the equipment during qualification testing.

PSRC

basic device (of a supervisory system): See: **common (basic) device (of a supervisory system)**

basic impulse insulation level (bil): A reference impulse insulation strength expressed in terms of the crest value of the withstand voltage of a standard full impulse voltage wave.

HW, SWg

baud: Defines the signaling speed, that is, keying rate of the modem.

The signaling speed in baud is equal to the reciprocal of the shortest element duration in seconds to be transmitted.

For example, in the following table, the signaling speed is calculated from the signaling element duration. In addition, the distinction between bit rate and baud for two different types of modem is illustrated.

Signaling Technique		
	Modem One	Modem Two
Signaling element duration		0.833 ms
Signaling speed		1200 Bd
Information transmitted per element duration	1b	2b
Bit rate	1200 b/s	2400 b/s

The bit rate and baud are not synonymous and shall not be interchanged in usage. Preferred usage is bit rate, with baud used only when the details of a communication modem or channel are specified.

SUB

bb auxiliary switch: See: **auxiliary switch** and **bb contact**.

LVSwgD; HVCB, Swg

bb contact: A contact that is closed when the operating mechanism of the main device is in the standard reference position and that is open when the operating mechanism is in the opposite position.

LVSwgD; HVCB, Swg

NOTE — See: **standard reference position**

bell crank: A lever with two arms placed at an angle diverging from a given point, thus changing the direction of motion of a mechanism.

HVS, Swg

bell crank hanger: A support for a bell crank.

HVS, SWg

benchboard: A combination of a control desk and a vertical switchboard in a common assembly.

SwgA:

biaxial test: The specimen under test is subject to acceleration in one principal horizontal axis and the vertical axis simultaneously.

PSRC; SwgA

bifurcated feeder: A stub feeder that connects two loads in parallel to their only power source.

SUB**bit:**

- 1) **least significant.** In an n bit binary word its contribution is (0 or 1) toward the maximum word value of (2^{n-1}) .
- 2) **most significant.** In an n bit binary word its contribution is (0 or 1 times 2^{n-1}) toward the maximum word value of (2^{n-1}) .

SUB

bit rate: The number of bits transferred in a given time interval. Bits per second is a measure of the rate at which bits are transmitted.

SUB

blade (disconnecting blade) (of a switching device): The moving contact member that enters or embraces the contact clips.

HVS, Swg; HVE, Swg

NOTE — In cutouts, the blade may be a fuse carrier or fuse holder on which a nonfusible member has been mounted in place of a fuse link. When so used, the non fusible member alone is also called a blade in fuse parlance.

blade guide (switch): An attachment to ensure proper alignment of the blade and contact clip when closing the switch.

HVS, SWg

blade latch: A latch used on a stick-operated switch to hold the switch blade in the closed position.

HVS, Swg

blinder: A relay having a characteristic on an $R-X$ diagram of one or more essentially straight lines, usually positioned at 75° to 90° from the R -axis and displaced from the origin.

PSRC

block (as applied to static relay design): An output signal of constant amplitude and specified polarity derived from an alternating input and with the duration controlled by the polarity of the input quantity.

PSRC

block-block element: A signal element in which two blocks are compared as to coincidence or sequence.

PSRC

blocking: A relay function which prevents action that would otherwise be initiated by the relay system.

PSRC

blocking relay: A relay whose function is to render another relay or device ineffective under specified conditions.

PSRC

block-spike element: A signal element in which a block and a spike are compared as to coincidence.

PSRC

bolted fault: A short-circuit condition that assumes zero impedance exists at the point of the fault.

PSRC

break distance (of a switching device): The minimum open-gap distance between the main-circuit contacts, or live parts connected there-to, when the contacts are in the open position.

HVF, Swg; HVS, Swg; LVSwgD; HVCB, Swg

NOTE — In a multiple-break device, it is the sum of the breaks in series.

buffer (buffer storage):

- 1) A device in which data are stored temporarily, in the course of transmission from one point to another; used to compensate for a difference in the flow of data, or time of occurrence of events, when transmitting data from one device to another.
- 2) An isolating circuit used to prevent a driven circuit from influencing a driving circuit.

SUB

burden (of a relay): Load impedance imposed by a relay on an input circuit expressed in ohms and phase angle at specified conditions.

PSRC

NOTE — If burden is expressed in other terms such as volt-amperes, additional parameters such as voltage, current, and phase angle must be specified.

bus: A conductor, or group of conductors, that serves as a common connection for two or more circuits.

SwgA

bus structure: An assembly of bus conductors, with associated connection joints and insulating supports.

SwgA

bus support: An insulating support for a bus. It includes one or more insulator units with fittings for fastening to the mounting structure and for receiving the bus.

HVSSWg

bushing: An insulating structure including a through conductor, or providing a passageway for such a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

HVCB, Swg

cable charging current: Current supplied to an unloaded cable.

HVCB, Swg

NOTE — Current is expressed in rms amperes.

calibration: The adjustment of a device to have the designed operating characteristics, and the subsequent marking of the positions of the adjusting means, or the making of adjustments necessary to bring operating characteristics into substantial agreement with standardized scales or marking.

PSRC; LVSwgD

calibration error: In the operation of a device, the departure, under specified conditions, of actual performance from performance indicated by scales, dials, or other markings on the device.

PSRC; LVSwgD

NOTE — The indicated performance may be by calibration markings in terms of input or performance quantities (amperes, ohms, seconds, etc.) or by reference to a specific performance data recorded elsewhere. *See also:*

setting error

calibration scale: A set of graduations marked to indicate values of quantities, such as current, voltage, or time at which an automatic device can be set to operate.

PSRC

capacitance-switching transient overvoltage ratio: The ratio of the peak value of voltage above ground, during the transient conditions resulting from the operation of the switch, to the peak value of the steady-state line-to-neutral voltage.

HVS, Swg; HVCB, Swg

NOTE — It is measured at either terminal of the switch, whichever is higher, and is expressed in multiples of the peak values of the operating line-to-ground voltages at the switch with the capacitance connected.

capacitive load: A lumped capacitance that is switched as a unit.

R and S, Swg

capacitor switch: A switch capable of making and breaking capacitive currents of capacitor banks.

R and S, Swg; HVS, Swg; HVCB, Swg

card extender: A device that provides access to components on a circuit card for testing purposes while maintaining all the electrical connections to the card.

PSRC

carrier, fuse: See: **fuse carrier (of an oil cutout)**

carrier-pilot protection: A form of pilot protection in which the communication means between relays is a carrier current channel.

PSRC

cartridge fuse: A low-voltage fuse consisting of a current-responsive element inside a fuse tube with terminals on both ends.

LVSwgD

cartridge size (of a cartridge fuse): The range of voltage and ampere ratings assigned to a fuse cartridge with specific dimensions and shape.

LVSwgD

cascading (of switching devices): The application of switching devices in which the devices nearest the source of power have interrupting ratings equal to, or in excess of, the available short-circuit current, while devices in succeeding steps further from the source, have successively lower interrupting ratings.

LVSwgD; HVCB, Swg

case (frame) ground protection: Over current relay protection used to detect current flow in the ground or earth connection of the equipment or machine.

PSRC

cathode ray tube (crt): A display device in which controlled electron beams are used to present alphanumeric or graphical data on an electroluminescent screen.

SUB

center-break switching device: A mechanical switching device in which both contacts are movable and engage at a point substantially midway between their supports.

LVSwgD

channel load factor: The percent of channel capacity in bits per second required to support the effective data rate for information exchange.

SUB

channel, scada: The communication path between master and remote stations.

SUB

checkboxack: The retransmission from the receiving end to the initiating end of a coded signal or message to verify, at the initiating end, the initial message before proceeding with the transmitting of data or a command.

SUB

checkboxack message: The response from the receiving end to the initiating end of a coded signal or message.

- 1) **partial checkback message.** Message from the initiating end is mirrored by the receiving end back to the initiating end to verify error-free transmission of the message.
- 2) **complete checkback message.** Message from the initiating end is interpreted by the receiving end. A new message is sent to the initiating end to verify error-free transmission and proper interpretation of the message.

SUB

circuit breaker: A mechanical switching device, capable of making, carrying, and breaking currents under normal circuit conditions and also, making and carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short circuit.

HVCB, Swg; LVSwgD**NOTES:**

- 1 — A circuit breaker is usually intended to operate infrequently, although some types are suitable for frequent operation.
- 2 — The medium in which circuit interruption is performed may be designated by suitable prefix, that is, air-blast circuit breaker, air circuit breaker, compressed-air circuit breaker, gas circuit breaker, oil circuit breaker, vacuum circuit breaker, oilless circuit breaker, etc.
- 3 — Circuit breakers are classified according to their application or characteristics and these classifications are designated by the following modifying words or clauses delineating the several fields of application, or pertinent characteristics:
 High-voltage power — Rated above 1000 V ac.
 Molded-case — See separate definition.
 Low-voltage power — Rated 1000 V ac or below, or 300 V dc and below, but not including molded-case circuit breakers.
 Direct-current low-voltage power circuit breakers are subdivided according to their specified ability to limit fault-current magnitude by being called general purpose, high-speed, semi-high-speed, rectifier or anode. For specifications of these restrictions see latest revision of the applicable standard.

circuit breaker, field discharge: A circuit breaker having main contacts for energizing and deenergizing the field of a generator, motor, synchronous condenser, or rotating exciter, and having discharge contacts for short-circuiting the field through the discharge resistor at the instant preceding the opening of the circuit-breaker main contacts. The discharge contacts also disconnect the field from the discharge resistor at the instant following the closing of the main contacts. For direct-current generator operation, the discharge contacts may open before the main contacts close.

LVSwgD

NOTE — When used in the main field circuit of an alternating- or direct-current generator, motor, or synchronous condenser, the circuit breaker is designated as a main field discharge circuit breaker. When used in the field circuit of the rotating exciter of the main machine, the circuit breaker is designated as an exciter field discharge circuit breaker.

circuit breaker, general purpose low-voltage dc power: A circuit breaker that, during interruption, does not limit the current peak of the available (prospective) fault current and may not prevent the fault current from rising to its sustained value.

LVSwgD

circuit-breaker grouping: The three poles of a circuit breaker grouped in adjacent configuration along the line of the same row.

SUB

circuit breaker, high-speed low-voltage dc power: A circuit breaker that, during interruption, limits the current peak to a value less than the available (prospective) fault current.

LVSwgD

circuit breaker, rectifier low-voltage dc power: A circuit breaker that carries the normal current output of one rectifier and that, during fault conditions, functions to withstand and/or interrupt abnormal current as required.

LVSwgD

circuit breaker, semi-high-speed low-voltage dc power: A circuit breaker that, during interruption, does not limit the current peak of the available (prospective) fault current on circuits with minimal inductance but that does limit current to a value less than the sustained current available on higher-inductance circuits.

LVSwgD

circuit switcher: A mechanical switching device with an integral interrupter, suitable for making, carrying, and interrupting currents under normal circuit conditions. It is also suitable for interrupting specified short-circuit current that may be less than its close and latch, momentary, and short-time current ratings.

HVS, Swg

NOTE — This device may be suitable for transformer protection where the majority of faults are limited by the transformer and system impedance.

circuit transient recovery voltage: See: **inherent transient recovery voltage**.

HVCB, Swg

Class A seismic component: That component or system whose failure, malfunction, or need for repair prevents the proper operation of the gas-insulated substation during or after the design earthquake.

SUB

Class B seismic component: That component or system whose failure, malfunction, or need for repair would not prevent the proper operation of the gas-insulated substation during or after the design earthquake. Class B components would be designed to either meet normal building codes and national standards in force at the site or another lower-level design earthquake. Application of further design requirements is left to the discretion of the user.

SUB

Class 1E: The safety classification of the electric equipment and systems that are essential to reactor emergency shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment.

PSRC, SwgA

clearance: See: **minimum clearance between poles (phases)** and **minimum clearance to ground**.

clearing time:

- 1) **of a mechanical switching device.** The interval between the time the actuating quantity in the main circuit reaches the value causing actuation of the release and the instant of final arc extinction on all poles of the primary arcing contacts.

R and S, Swg; LVSwgD; HVCB, Swg

NOTE — Clearing time is numerically equal to the sum of contact parting time and arcing time.

- 2) **total clearing time of a fuse.** The time elapsing from the beginning of a specified overcurrent to the final circuit interruption, at rated maximum voltage.

HVF, Swg

NOTE — The clearing time is equal to the sum of melting time and the arcing time.

clips: See: **contact clips (of a mechanical switching device)** and **fuse clips (contact clips or fuse contacts)**.

close and latch: The capability of a switching device to close (allow current flow) and immediately thereafter latch (remain closed) and conduct a specified current through the device under specified conditions.

HVCB, Swg; R and S, Swg

close-open operation (of a switching device): A close operation followed immediately by an open operation without purposely delayed action.

LVSwgD; HVS, Swg; HVCB, Swg

NOTE — The letters CO signify this operation: Close-Open.

close operation (of a switching device): The movement of the contacts from the normally open to the normally closed position.

LVSwgD; HVCB, Swg

NOTE — The letter C signifies this operation: Close.

close-time delay-open operation (of a switching device): A close operation followed by an open operation after a purposely delayed action.

LVSwgD; HVCB, Swg

NOTE — The letters CTO signify this operation: Close-Time Delay-Open.

closing coil (of a switching device): A coil used in the electromagnet that supplies power for closing the device.

LVS_{wgD}; HV_{CB}, Sw_g

NOTE — In an air-operated, or other stored-energy-operated device, the closing coil may be the coil used to release the air or other stored energy that in turn closes the device.

closing operating time: The interval during which the contacts move from the fully open position to the fully closed position.

HVS, Sw_g

closing relay: A form of auxiliary relay used with an electrically operated device to control the closing and opening of the closing circuit of the device so that the main closing current does not pass through the control switch or other initiating device.

LVS_{wgD}; PSRC; HV_{CB}, Sw_g

closing time (of a mechanical switching device): The interval of time between the initiation of the closing operation and the instant when metallic continuity is established in all poles.

HVS, Sw_g; LVS_{wgD}; HV_{CB}, Sw_g

NOTES:

- 1 — It includes the operating time of any auxiliary equipment that is necessary to close the switching device, and that forms an integral part of the switching device.
- 2 — For switching devices that embody switching resistors, a distinction should be made between the closing time up to the instant of establishing a circuit at the secondary arcing contacts, and the closing time up to the establishment of a circuit at the main or primary arcing contacts, or both.

common (basic) device (of a supervisory system): A device in either the master or remote station that is required for the basic operation of the supervisory system and is not part of the equipment for the individual points.

SUB

common equipment: That complement of either the master or remote station supervisory equipment that interfaces with the interconnecting channel and is otherwise basic to the operation of the supervisory system, but is exclusive of those elements that are peculiar to and required for the particular applications and uses of the equipment.

SUB

common-mode failure: A multiple failure attributable to a common cause.

PSRC

common-mode voltage: The voltage common to all conductors of a group as measured between that group at a given location and an arbitrary reference (usually earth).

PSRC

communications interface equipment: A portion of a relay system that transmits information from the relay logic to a communications link, or conversely to logic, for example, audio tone equipment, a carrier transmitter-receiver when an integral part of the relay system.

PSRC

comparer: A signal element that performs an AND logic function.

PSRC

compartment (GIS): Any gas section of the gas-insulated substation assembly that can be isolated from the system by internal or external means.

SUB

compensator (as applied to relaying): A transducer with an air-gapped core that produces an output voltage proportional to input current. The voltage modifies (or *compensates*) the voltage applied to the relay.

PSRC

components: Items from which the switchgear assemblies are made (for example, power circuit breakers, instrument transformers, protective relays, control switches, primary insulation, etc.).

Sw_{gA}

computer interface equipment: A device that interconnects a protective relay system to an independent computer, for example, a scanner or a buffer amplifier.

PSRC

condenser (of a fuse): *See: fuse condenser.*

conductance relay: A mho relay for which the center of the operating characteristic on the R - X diagram is on the R -axis.

PSRC

NOTE — The equation that describes such a characteristic is $Z/K \cos\theta$, where K is a constant and θ is the phase angle by which the input voltage leads the input current.

conducting element (fuse link) (of a fuse): The conducting means, including the current-responsive element, for completing the electric circuit between the terminals of a fuse-holder or fuse unit.

HVF, Swg

conducting mechanical joint: The juncture of two or more conducting surfaces held together by mechanical means.

HVS, Swg; LVSwgD; HVCB, Swg; SwgA

NOTE — Parts jointed by fusion processes, such as welding, brazing, or soldering, are excluded from this definition.

conformance tests: Those tests made to demonstrate compliance with the applicable standards. The test specimen is normally subjected to all planned production tests prior to initiation of the conformance test program.

SUB; R and S, Swg; SwgA

NOTE — The conformance tests may, or may not, be similar to certain design tests. Demonstration of margin (capabilities) beyond the standards is not required.

connected position (of a switchgear-assembly removable element): That position of the removable element in which both primary and secondary disconnecting devices are in full contact.

SwgA

connecting rod or shaft: A component of a switch operating mechanism designed to transmit motion from an offset bearing or bell crank to a switch pole unit.

HVS, SWg

connection diagram: A diagram showing the relation and connections of devices and apparatus of a circuit or a group of circuits.

LVSwgD

console: That component of the system that provides facilities for control and observation of the system. Examples include operator's console and maintenance console.

SUB, SwgA

contact: A conducting part that coacts with another conducting part to make or break a circuit.

HVS, Swg; LVSwgD; HVCB, Swg

contact clip (of a mechanical switching device): The clip that the blade enters or embraces.

HVS, Swg

contact converter (as applied to relaying): A buffer element used to produce a prescribed output as the result of the opening or closing of a contact.

PSRC

contact current-carrying rating of a relay: The current that can be carried continuously or for stated periodic intervals without impairment of the contact structure or interrupting capability.

PSRC

contact current-closing rating of a relay: The current that the device can close successfully with prescribed operating duty and circuit conditions without significant impairment of the contact structure.

PSRC

contact interrupting rating of a relay: The current that the device can interrupt successfully with prescribed operating duty and circuit conditions without significant impairment of the contact structure.

PSRC

contact (of a relay): A conducting part that acts with another conducting part to make or break a circuit.

PSRC

contact opening time (of a relay): The time a contact remains closed while in process of opening following a specified change of input.

PSRC

contact parting time (of a mechanical switching device): The interval between the time when the actuating quantity in the release circuit reaches the value causing actuation of the release and the instant when the primary arcing contacts have parted in all poles.

R and S, Swg; HVCB, Swg

NOTE — Contact parting time is the numerical sum of release delay and opening time.

contact position indicator: A device that is located at or near the operating mechanism to indicate whether the main contacts are in the closed or open position. Typically colors are used to indicate a closed or open position; red shall signify closed and green shall signify open.

HVS, Swg; LVSwgD; HVCB, Swg

contact surface: That surface of a contact through which current is transferred to the coacting contact.

HVS, Swg; LVSwgD; HVCB, Swg

contact-wear allowance: The total thickness of material that may be worn away before the coacting contacts cease to perform adequately.

HVS, Swg; R and S, Swg

contention: An operational condition on a data communication channel in which no station is designated a master station. In contention, each station on the channel shall monitor the signals on the channel and wait for a quiescent condition before initiating a bid for circuit control.

SUB

continuous-current tests: Tests made at rated current, until temperature rise ceases, to determine that the device or equipment can carry its rated continuous current without exceeding its allowable temperature rise.

HVCB, Swg

continuous enclosure: A bus enclosure in which the consecutive sections of the enclosure for the same phase conductor are electrically bonded together to provide a continuous current path throughout the entire enclosure length.

SUB

NOTE — Cross-connections to the other phase enclosures are made only at the extremities of the installation and at selected intermediate points.

continuous monitoring: The process of sampling the state of some phenomenon either continuously or at a sample interval of one second or less.

SUB

control: The execution of a system change by manual means, remote means, automatic means, or partially automatic means.

- 1) **automatic.** An arrangement of electrical controls that proves for switching or controlling, or both, of equipment in an automatic sequence and under predetermined conditions.
- 2) **closed loop.** A type of automatic control in which control actions are based on signals fed back from the controlled equipment or system. For example, remote stations can manage local voltage conditions by control of load tap changers and volt-amperes reactive (VAR) control compensation equipment.
- 3) **open loop.** A form of control without feedback.
- 4) **manual.** Control in which the system or main device, whether direct or power-aid-ed in operation, is directly controlled by an attendant.

- 5) **partial automatic.** Control that is a combination of manual and automatic control. For example, to cause a voltage reduction, the local automatic load tap changing closed-loop control may be biased by way of a supervisory control command.
- 6) **remote.** Control of a device from a distant point.

SUB

control bus: A bus used to distribute power for operating electrically controlled devices.

HVCB, Swg

control desk: A control switchboard consisting of one or more relatively short horizontal or inclined panels mounted on an assembly of such a height that the panel-mounted devices are within convenient reach of an attendant.

SwgA

control relay: An auxiliary relay whose function is to initiate or permit the next desired operation in a control sequence.

PSRC, HVCB, Swg

control switch: A manually operated switching device for controlling power-operated devices.

HVCB, Swg

NOTE — It may include signaling, interlocking, etc., as dependent functions.

control switchboard: A type of switchboard including control, instrumentation, metering, protective (relays) or regulating equipment for remotely controlling other equipment. Control switchboards do not include the primary power circuit-switching devices or their connections.

SwgA

control voltage: The voltage applied to the operating mechanism of a device to actuate it, usually measured at the control power terminals of the mechanism.

LVSwgD; HVCB, Swg

conversion (switchgear): A general term covering the process of altering existing power switchgear equipment.

HVCB, Swg; SwgA; LVSwgD

correct relay operation: An output response by the relay that agrees with the operating characteristic for the input quantities applied to the relay.

PSRC

NOTE — See also: **correct relaying-system performance.**

correct relaying-system performance: The satisfactory operation of all equipment associated with the protective-relaying function in a protective-relaying system. It includes the satisfactory presentation of system input quantities to the relaying equipment, the correct operation of the relays in response to these input quantities, and the successful operation of the assigned switching device or devices.

PSRC

counting mechanism (of an automatic line sectionalizer or automatic circuit recloser): A device that counts the number of electrical impulses and, following a predetermined number of successive electrical impulses, actuates a releasing mechanism. It resets if the total predetermined number of successive impulses do not occur in a predetermined time.

R and S, Swg

counting operation (of an automatic line sectionalizer or automatic circuit recloser): Each advance of the counting mechanism towards an opening operation.

R and S, Swg

counting operation time (of an automatic line sectionalizer): The time between the cessation of a current above the minimum actuating current value and the completion of a counting operation.

R and S, Swg

creepage distance: The shortest distance between two conducting parts measured along the surface or joints of the insulating material between them.

LVS_{wgD}

critical impulse (of a relay): The maximum impulse in terms of duration and input magnitude that can be applied suddenly to a relay without causing pickup.

PSRC

critical impulse time (of a relay): The duration of a critical impulse under specified conditions.

PSRC

critical overtravel time (of a relay): The time following a critical impulse until movement of the responsive element ceases just short of pickup.

PSRC

critical travel (of a relay): The amount of movement of the responsive element of a relay during a critical impulse, but not subsequent to the impulse.

PSRC

current-balance relay: A balance relay that operates by comparing the magnitudes of two current inputs.

PSRC

current-carrying part: A conducting part intended to be connected in an electric circuit to a source of voltage.

HVF, Swg; HVS, Swg; LVS_{wgD}; HVCB, Swg

NOTE — Non-current-carrying parts are those not intended to be so connected.

current injection method: A synthetic test method in which the voltage circuit is applied to the test circuit breaker before power frequency current zero.

HVCB, Swg

current-limiting fuse unit: A fuse unit that, when it is melted by a current within its specified current-limiting range, abruptly introduces a high resistance to reduce the current magnitude and duration.

HVF, Swg

NOTES:

1 — There are two classes of current-limiting fuse units—power and distribution. They are differentiated one from the other by current ratings and minimum melting time current characteristics.

2 — The values specified in standards for the threshold ratio, peak let-through current, and 1^2t characteristics are used as the measures of current-limiting ability.

current-limiting (peak let-through or cutoff) characteristic curve: A curve showing the relationship between the maximum peak current passed by a device and the correlated rms available current magnitude under specified voltage and circuit impedance conditions.

HVF, Swg

current-limiting range (of a current-limiting fuse): That specified range of currents between the threshold current and the rated interrupting current within which current limitation occurs.

HVF, Swg

current, peak: The instantaneous value of current at the time of its maximum value.

LVS_{wgD}

current phase-balance protection: A method of protection in which an abnormal condition within the protected equipment is detected by the current unbalance between the phases of a normally balanced polyphase system.

PSRC

current rating of a relay: The limiting current at specified frequency that may be sustained by the relay for an unlimited period without causing any of the prescribed limitations to be exceeded.

PSRC

current relay: A relay that responds to current.

PSRC

current-responsive element (of a fuse): That part with predetermined characteristics, the melting and severance or severances of which initiate the interrupting function of the fuse.

HVF, Swg

NOTE — The current-response element may consist of one or more fusible elements combined with a strain element or other component(s), or both, that affect(s) the current-responsive characteristic.

current-type telemeter: A telemeter that employs the magnitude of a single current as the translating means.

SUB

cutoff characteristic (of a current-limiting fuse): See: **current-limiting (peak let-through or cutoff) characteristic curve**.

cutout: An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link), or may act as a disconnecting blade by the inclusion of a nonfusible member.

HVF, Swg

NOTE — The term *cutout*, as defined here, is restricted in practice to equipment used on distribution systems. See: **distribution** and **distribution cutout**. For fuses having similar components used on power systems, see: **power** and **power fuse**.

damping: A dynamic property of a vibrating structure that indicates its ability to dissipate mechanical energy. The phenomenon of damping is represented by a quantity called the damping factor, which is expressed as a percentage of critical damping. After being forced to deflect and allowed to freely vibrate, structures with zero damping will vibrate with a harmonic motion indefinitely. Structures with critical damping will creep back to their static or neutral position with no velocity reversal.

SUB, SwgA

data: Any representation of a digital or analog quantity to which meaning has been assigned.

SUB

data acquisition: The collection of data.

SUB

data acquisition system: A centralized system that receives data from one or more remote points—a telemetering system. Data may be transported by either analog or digital telemetering.

SUB

data logging: An arrangement for the alpha-numerical representation of selected quantities on log sheets; papers, magnetic tape, or the like, by means of an electric typewriter or other suitable devices.

SUB

data rate: The rate at which a data path (for example, channel) carries data, measured in bits per second (b/s).

SUB

dead band: The range through which an input can be varied without initiating response.

SUB

dead-front mounting (of a switching device): A method of mounting in which a protective barrier is interposed between all live parts and the operator, and all exposed operating parts are insulated or grounded.

SwgA

NOTE — The barrier is usually grounded metal.

dead-front pad-mounted switchgear (PMSG): A switchgear assembly in which all energized parts are insulated and completely enclosed within a grounded shield system when separable connectors are in place. The overall enclosure is of suitable environmental and tamper-resistant construction for outdoor above-ground installation. The term *front* refers specifically to any side of the enclosure that provides access to enclosed accessories external to the ground shield system.

R and S, Swg

dead-front switchboard: A switchboard that has no exposed live parts on the front.

SwgA

NOTE — The switchboard panel is normally grounded metal and provides a barrier between the operator and all live parts.

dead-tank switching device: A switching device in which a vessel(s) at ground potential surrounds and contains the interrupter(s) and the insulating medium.

HVCB, Swg

dead time (of a circuit breaker on a reclosing operation): The interval between interruption in all poles on the opening stroke and reestablishment of the circuit on the reclosing stroke.

PCB, Swg

NOTES:

- 1 — In breakers using arc-shunting resistors, the following intervals are recognized and the one referred to should be stated:
 - a) Dead time from interruption on the primary arcing contacts to reestablishment through the primary arcing contacts.
 - b) Dead time from interruption on the primary arcing contacts to reestablishment through the secondary arcing contacts.
 - c) Dead time from interruption on the secondary arcing contacts to reestablishment on the primary arcing contacts.
 - d) Dead time from interruption on the secondary arcing contacts to reestablishment on the secondary arcing contacts.
- 2 — The dead time of an arcing fault on a reclosing operation is not necessarily the same as the dead time of the circuit breakers involved, since the dead time of the fault is the interval during which the faulted conductor is deenergized from all terminals.

definite-minimum-time relay: An inverse-time relay in which the operating time becomes substantially constant at high values of input. See Fig 1.

PSRC

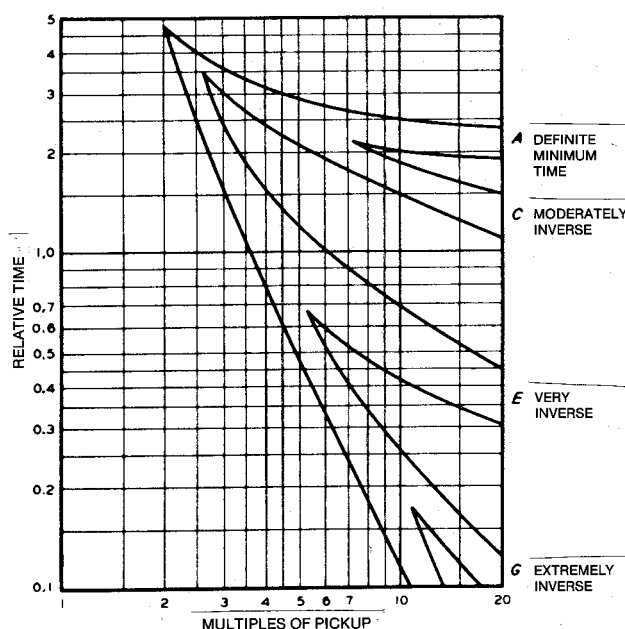


Figure 1— Typical Operating Characteristic Curve Shapes of Various Inverse-Time Relays (PSRC)

definite-purpose circuit breaker: A circuit breaker that has been designed, tested, and rated in accordance with general-purpose circuit breaker requirements of applicable standards and that has been designed, tested, and rated in accordance with the requirements of one or more specific performance requirements for a definite-purpose circuit breaker.

HVCB, Swg

definite-time delay: A qualifying term indicating that there is purposely introduced a delay in action, which delay remains substantially constant regardless of the magnitude of the quantity that causes the action.

LVSwd; HVCB, Swg

definite-time relay: A relay in which the operating is substantially constant regardless of the magnitude of the input quantity.

PSRC

degree of asymmetry (of a current at any time): The ratio of the direct-current component to the peak value of the symmetrical component determined from the envelope of the current wave at that time.

LVS_{wgD}; HVCB, Swg

NOTE — This value is 100% when the direct-current component equals the peak value of the symmetrical component.

delayed overcurrent trip: See: **delayed release (trip)** and **overcurrent release (trip)**.

delayed release (trip): A release with intentional delay introduced between the instant when the activating quantity reaches the release setting and the instant when the release operates.

LVS_{wgD}

dependability(of a relay or relay system): The facet of reliability that relates to the degree of certainty that a relay or relay system will operate correctly.

PSRC

dependent biaxial test: A test in which the horizontal and the vertical acceleration components are derived from a single-input signal.

PSRC

dependent manual operation: An operation solely by means of directly applied manual energy, such that the speed and force of the operation are dependent upon the action of the attendant.

LVS_{gD}

dependent power operation: An operation by means of energy other than manual, where the completion of the operation is dependent upon the continuity of the power supply (to solenoids, electric or pneumatic motors, etc.).

LVS_{wgD}; HVE, Swg; HVCB, Swg

design basis events (DBEs): Postulated events, specified by the safety analysis of the station, used in the design to establish the acceptable performance requirements of the structures and systems.

PSRC

design earthquake: The greatest earthquake postulated during the life of the gas-insulated substation that the user wishes the gas-insulated substation to survive.

SUB

design life: The time during which satisfactory performance can be expected for a specific set of service conditions.

PSRC

design pressure (working pressure): The maximum gas pressure to which a gas-insulated substation enclosure will be subjected under normal operating conditions.

SUB

design tests: Those tests made to determine the adequacy of a particular type, style, or model of equipment with its component parts to meet its assigned ratings and to operate satisfactorily under normal service conditions or under special conditions if specified.

LVS_{wgD}; HVCB, Swg; HVE, Swg

NOTE — Design tests are made only on representative apparatus to substantiate the ratings assigned to all other apparatus of basically the same design. These tests are not intended to be used as a part of normal production. The applicable portion of these design tests may also be used to evaluate modifications of a previous design and to assure that performance has not been adversely affected. Test data from previous similar designs may be used for current designs, where appropriate.

design verification (switchgear): A general term covering the overall qualification of any conversion to standards by means of design testing supported by justified technical evaluation.

HVCB, Swg; SwgA; LVS_{wgD}

device (electrical equipment): An operating element such as a relay, contactor, circuit breaker, switch, valve, or governor used to perform a given function in the operation of electrical equipment.

SUB

dew withstand voltage test: A test to determine the ability of the insulating system to withstand specified overvoltages for a specified time without flashover or puncture while completely covered with dew.

SwgA

dielectric withstand-voltage tests: Tests made to determine the ability of insulating materials and spacings to withstand specified overvoltages for a specified time without flash-over or puncture.

HW, Swg; LVSwgD; HVCB, Swg; SwgA

differential capacitance voltage: The difference in magnitudes of the rms system normal frequency line-to-neutral voltage multiplied by the square root of two, with and without the capacitance connected.

HVS, Swg; HVCB, Swg

NOTE — This can be calculated from the equations:

$$\Delta V = \sqrt{2}E_S \frac{X_L}{X_C - X_L} \text{ or}$$

$$\Delta V = \sqrt{2}E_S \frac{\text{kvar}}{\text{kVA}_{SC} - \text{kvar}}$$

where

- ΔV = Differential capacitance voltage in volts
- E_S = System phase-to-neutral voltage in volts rms
- X_L = Source inductive reactance to point of application, in ohms per phase
- X_C = Capacitive reactance of bank being switched in ohms per phase
- kvar = Size of bank being switched (three phase)
- kVA_{SC} = System short-circuit kVA at point of capacitor application (symmetrical three phase)

differential protection: A method of apparatus protection in which an internal fault is identified by comparing electrical conditions at all terminals of the apparatus.

PSRC

differential relay: A relay that by its design or application is intended to respond to the difference between incoming and outgoing electrical quantities associated with the protected apparatus.

PSRC

differentiator(relaying): A transducer whose output wave form is substantially the time derivative of its input wave form.

PSRC

digital converter (code translator): A device, or group of devices, that converts an input numerical signal or code of one type into an output numerical signal or code of another type.

SUB

digital quantity: A variable represented by a number of discrete units.

SUB

digital readout clock: A clock that gives (usually with visual indication) a voltage or contact closure pattern of electrical circuitry for a read-out of time. A digital readout calendar clock also includes a readout of day, month, and year, usually, also with indication.

SUB

digital telemeter indicating receiver: A device that receives the numerical signal transmitted from a digital telemeter transmitter and gives a visual numerical display of the quantity measured.

SUB

digital telemeter receiver: A device that receives the numerical signal transmitted by a digital telemeter transmitter and stores it or converts it to a usable form, or both, for such purposes as recording, indication, or control.

SUB

digital telemeter transmitter: A device that converts its input signal to a numerical form for transmission to a digital telemeter receiver over an interconnecting channel.

SUB

digital telemetering: Telemetering in which a numerical representation, as for example some form of pulse code, is generated and transmitted; the number being representative of the quantity being measured.

SUB

digital-to-analog converter: A device, or group of devices, that converts a numerical input signal or code into an output signal some characteristic of which is proportional to the input.

SUB

digital-to-analog (d/a) conversion: Production of an analog signal whose magnitude is proportional to the value of a digital input.

SUB

direct-acting machine-voltage regulator: A machine-voltage regulator having a voltage-sensitive element that acts directly without interposing power-operated means to control the excitation of an electric machine.

LVSwgD

direct-acting overcurrent trip device: A release or tripping system that is completely self-contained on a circuit breaker and requires no external power or control circuits to cause it to function.

LVSwgD

direct-acting overcurrent trip device current rating: The value of current designated by the manufacturer on which trip element calibration marks are based.

LVSwgD

direct-current component (of a total current): That portion of the total current which constitutes the asymmetry.

LVSwgD; HVCB, Swg

direct operation: Operation by means of a mechanism connected directly to the main operating shaft or an extension of the same.

HVS, SWg

direct release (series trip): A release directly energized by the current in the main circuit of a switching device.

LVSwgD; HVCB, Swg

direct test: A test in which the applied voltage, current, and recovery voltage is obtained from a single power source, which may be comprised of generators, transformers, networks, or combinations of these.

HVCB, Swg

directional-comparison protection: A form of pilot protection in which the relative operating conditions of the directional units at the line terminals are compared to determine whether a fault is in the protected line section.

PSRC

directional control (as applied to a protective relay or relay scheme): A qualifying term that indicates a means of controlling the operating force in a nondirectional relay so that it will not operate until the two or more phasor quantities used to actuate the controlling means (directional relay) are in a predetermined band of phase relations with a reference input.

PSRC

directional-current tripping: *See: directional-overcurrent protection and directional-overcurrent relay.*

directional-ground relay: A directional relay used primarily to detect single-phase-to-ground faults, but also sensitive to double-phase-to-ground faults.

PSRC

NOTE — This type of relay is usually operated from the zero-sequence components of voltage and current, but is sometimes operated from negative-sequence quantities.

directional-overcurrent protection: A method of protection in which an abnormal condition within the protected equipment is detected by the current being in excess of a predetermined amount and in a predetermined band of phase relations with a reference input.

PSRC

directional-overcurrent relay: A relay consisting of an overcurrent unit and a directional unit combined to operate jointly.

PSRC

directional-power relay: A relay that operates in conformance with the direction of power.

PSRC

directional-power tripping: *See: directional-power relay.*

directional relay: A relay that responds to the relative phase position of a current with respect to another current or voltage reference.

PSRC

NOTE — The above definition, which applies basically to a single-phase directional relay, may be extended to cover a polyphase directional relay

disable: A command or condition that prohibits some specific event from proceeding.

SUB

discharge resistor: A resistor that, upon interruption of excitation source current, is connected across the field windings of a generator, motor, synchronous condenser, or an exciter to limit the transient voltage in the field circuit and to hasten the decay of field current of these machines.

LVSwgD

disconnected position (of a switchgear-assembly removable element): That position in which the primary and secondary disconnecting devices of the removable element are separated by a safe distance from the stationary element contacts.

SwgA

NOTE — Safe distance, as used here, is a distance at which the equipment will meet its withstand ratings, both power frequency and impulse, between line and load stationary terminals and phase-to-phase and phase-to-ground on both line and load stationary terminals with the switching device in the closed position.

disconnecting blade: *See: blade (disconnecting blade) (of a switching device).*

disconnecting cutout: A distribution cutout, having a disconnecting blade, that is used for closing, opening, or changing the connections in a circuit or system, or for isolating purposes.

HVF, Swg

NOTE — Some load-break ability is inherent in the device, but it has no load-break rating. This ability can best be evaluated by the user, based on experience under operating conditions.

disconnecting fuse: *See: fuse-disconnecting switch (disconnecting fuse).*

disconnecting or isolating switch (disconnecter, isolator): A mechanical switching device used for changing the connections in a circuit, or for isolating a circuit or equipment from the source of power.

HVF; Swg; HVS, Swg

NOTE — It is required to carry normal load current continuously, and also abnormal or short-circuit currents for short intervals as specified. It is also required to open or close circuits either when negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the switch poles occurs.

display graphic: A hardware device (crt, plasma panel, arrays of lamps, or light-emitting diodes) used to present pictorial information.

SUB

disruptive discharge: A term that relates to phenomena associated with the breakdown of insulation under electrical stress, in which the discharge completely bridges the insulation under test, reducing the voltage between the electrodes